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October 2, 2012
Montreal, Quebec

Chairperson: Eddy Kennedy
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Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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SUMMARY

Canada has both domestic and international commitments to establish a national network of Marine Protected Areas (MPAs). Towards this goal, Fisheries and Oceans Canada (DFO) is working with federal, provincial and territorial partners to design and establish the Canadian network of MPAs in accordance with Decision IX/20 of the Convention on Biological Diversity (CBD) (UNEP 2008). One of the required network properties and components identified in Annex II of the CBD decision is representativity. Representativity, as defined in COP IX/20, is captured in a network when it consists of areas representing the different biogeographical subdivisions of the global oceans and regional seas that reasonably reflect the full range of ecosystems, including the biotic and habitat diversity of those marine ecosystems. Past Science advice has laid much of the foundation for how Canada can proceed to establish its representative network of MPAs as well as providing general guidance on the necessary properties of networks of marine protected areas, including representative areas (DFO 2004, 2009, 2010, and 2011). However, this past advice did not provide a framework to ensure consistency across bioregions in the selection of scale (i.e., level of subdivision) at which representativity must be achieved within the network, nor regarding how an area would be considered to be representative or what ecological functions are to be served by representative areas. The objective of this national peer review process was to develop a nationally consistent interpretation of representativity in the context of Canada's network of MPAs and to provide guidance on: 1) the ecological functions that are to be served by representative areas within an MPA, as well as the required properties to ensure those functions are sustained; and 2) the appropriate factors to consider in selecting the scale (level of subdivision) to produce the biogeographical units that need to be represented in the network. This process, which was held October 2, 2012 in Montreal, Quebec, included participants from DFO Ecosystems and Oceans Science, Oceans Program Policy, Parks Canada, Environment Canada, provincial and territories experts, and academia. Publications resulting from this process include a Science Advisory Report, a Research Document, and these proceedings.

SOMMAIRE

Le Canada s'est engagé, à l'échelle nationale et internationale, à établir un réseau national d'aires marines protégées (AMP). Pour atteindre cet objectif, Pêches et Océans Canada (MPO) travaille en collaboration avec des partenaires fédéraux, provinciaux et territoriaux en vue de concevoir et d'établir un réseau canadien d'AMP conformément à la décision IX/20 de la Convention sur la diversité biologique (CDB) [Programme des Nations Unies pour l'environnement ou PNUE 2008]. Une des composantes et propriétés requises pour le réseau et indiquées à l'annexe II de la décision de la CDB est la représentativité. Selon la définition contenue dans la décision IX/20 de la CdP, la représentativité consiste en l'inclusion dans un réseau d'aires représentant les différentes subdivisions biogéographiques des océans et des mers qui reflètent raisonnablement l'éventail complet des écosystèmes, y compris la diversité des biotes et des habitats de ces écosystèmes marins. Les avis scientifiques antérieurs ont jeté les bases des procédés en vertu desquels le Canada peut établir ses réseaux représentatifs d'AMP et fournir une orientation générale sur les propriétés exigées aux réseaux d'aires marines protégées, y compris les aires représentatives (MPO 2004, 2009, 2010 et 2011). Cependant, les avis scientifiques antérieurs n'ont pas fourni de cadre qui assure, pour toutes les biorégions, l'uniformité de l'échelle sélectionnée (c.-à-d. niveau de sous-divisions) à laquelle la représentativité doit être garantie dans le réseau; ils ne se sont pas non plus penchés sur ce qui rend représentative une aire ni sur les fonctions écologiques que les aires représentatives sont censées soutenir. Ce processus d'examen par des pairs national vise à mettre au point une interprétation nationale cohérente du terme « représentativité » dans le contexte du réseau canadien d'AMP et à fournir des orientations concernant : 1) les fonctions écologiques que les aires représentatives au sein d'une AMP sont censées soutenir ainsi que les propriétés nécessaires pour veiller à ce que les fonctions soient soutenues; 2) les facteurs à considérer dans le choix d'une échelle (niveau de subdivision) pour déterminer les unités biogéographiques à représenter dans le réseau. Ce processus, qui s'est tenu le 2 octobre 2012 à Montréal (Québec), a accueilli des participants venus du Secteur des sciences des écosystèmes et des océans et de Politiques relatives aux programmes sur les océans du MPO, de Parcs Canada, d'Environnement Canada ainsi que des experts des provinces et territoires, et du monde universitaire. Les publications qui ont découlé de ce processus consistent en un avis scientifique, un document de recherche et le présent compte rendu..

INTRODUCTION

The Chair, Eddy Kennedy, opened the meeting and provided a brief overview of the purpose of the meeting. The objective of this national peer review process was to develop a nationally consistent interpretation of representativity in the context of Canada's network of MPAs and to provide guidance on: 1) the ecological functions that are to be served by representative areas within an MPA, as well as the required properties to ensure those functions are sustained; and 2) the appropriate factors to consider in selecting the scale (level of subdivision) to produce the biogeographical units that need to be represented in the network.

Participants were provided an opportunity to introduce themselves via a round table. A brief presentation was given on the CSAS peer review process and relevant policies and guidelines. The agenda and terms of reference including the objectives for the meeting were reviewed. Participants were provided an opportunity for questions.

PRESENTATIONS

REPRESENTATIVITY AND NETWORKS OF MARINE PROTECTED AREAS

Presenter - J. Rice

As a result of several delays of this national peer review process, this paper had already been published in the journal Aquatic Conservation: Marine and Freshwater Ecosystems and did not undergo peer review during the meeting. Nevertheless, this paper was considered to be fundamental information for this process and, therefore, was presented.

Abstract

Through recent decisions of the Convention on Biological Diversity (CBD), States have agreed to establish networks of marine protected areas (MPAs), and that representativity is a necessary feature of the networks. There is extensive literature on the intent of these commitments and scientific guidance on network design. The guidance specifies that to have representativity captured in a network requires that a suitable biogeographical classification exists and that areas which 'represent' the biogeographical subdivisions are included. However, no operational guidance has been provided on how to determine that a subdivision is adequately 'represented' by a protected area. The paper looked at the management and conservation functions expected to be served by representative MPAs, including an 'insurance policy' function, a 'benchmark' or natural control function, and a 'seed stock' function. The scales at which marine ecological processes typically operate are reviewed as a basis for determining the scales of MPAs needed to provide these functions. It was concluded that representative MPAs at the spatial scales of the interactions of key top predators and forage fish generally should be large enough to give protection to the other processes as well. To ensure the key functions are served, the representative MPAs also should have sufficient protection that human pressures do not alter the characteristics of these ecological processes (Rice and Houston, 2011).

Discussion

- With respect to the three functions, does the indication that human uses would impair these functions mean that we would need to have no human use (i.e., no take)? In response the presenter indicated that representative areas need to be large and have stringent management to achieve success in achieving these functions. Any human uses inside a representative MPA would impact, and likely remove entirely, the ability of the area to serve the benchmark function. It was further explained that human impacts are rarely fully

understood. For example, how much use can be permitted before the insurance policy function is lost is a complex question. It was suggested that if all three of the management and conservation functions are desired, exploitation should be a third or less of natural mortality (at the upper bounds) to sustain the key functions. It was further added that even fishing mortality of one third of natural mortality could impact the population if there is high natural mortality.

- In the context of requiring large, stringently managed protected areas, a discussion ensued on aligning such requirements with the IUCN categories of protected areas. It was suggested that these conditions fall within the IUCN categories I to III, but are rarely met by the IUCN categories IV to VI. It was noted that IUCN category VI has a large natural component to it and allows for low levels of non-industrial, sustainable resource management. In response, the presenter noted that if there is a conflict between use and conservation objectives, then the conservation objective is supposed to take precedence, but this may not always work in practice.
- There was discussion on the definition of 'large' area to ensure ecosystem structure and functions are represented. It was suggested that the functions linked to primary productivity can be met by protected areas in the 10s to 100s square km range. Functions linked to grazing should be able to be met by an area in a similar size range. For benthic communities, it would be expected in most situations that stability of community patterns would be achieved in an area on order of 10s to 100s of square km. For piscivorous fish, the area required for confidence in achieving representative patterns of structure and function is on the order of 100s to 1000s of square km. In addition, multiple areas may be necessary for protecting important life history stages.

INTERNATIONAL APPROACHES TO CHARACTERIZING MARINE SEASCAPES TO ACHIEVE REPRESENTATIVITY IN MPA NETWORK DESIGN

Presenter – V. Sheppard

Abstract

To design marine protected area (MPA) networks in 12 bioregions across the country (excluding the Great Lakes' region), Canada will apply the Convention on Biological Diversity's scientific guidance regarding required network properties and components; this list includes "representativity". There is little guidance available regarding how to apply this network property in practice, particularly with respect to defining the appropriate scale of biogeographic subdivision to reflect the full range of marine ecosystems, including biotic and habitat diversity. Therefore, to inform the development of national scientific guidance to support bioregional MPA network planning in Canada, this paper investigates various approaches other jurisdictions have taken internationally to address this question. No jurisdiction took the approach of specifying outright the scale at which they will apply the representativity property. Most jurisdictions took a systematic approach to characterizing marine landscapes/seascapes, subdivided primarily using geophysical, plus some biological, factors. Such an approach is an option for the Canadian context, considering benthic and pelagic ecosystems separately, and proceeding at different scales for coastal versus offshore areas. In order to achieve national consistency, scientific guidance on the types of factors to consider in bioregional landscape/seascape characterisation is needed.

Expert Review (M. Greenlaw)

- M. Greenlaw presented an expert review of the paper (Appendix 3). Overall she noted that although the document did a great job at summarizing international examples, it did not summarize the full breadth of knowledge about representative planning methods. It was also

noted that since the working paper was prepared, Australia has moved forward and used the Gradient Forest approach.

Discussion

- There is a need for national consistency on how to divide bioregional areas to achieve representativity. Most other jurisdictions have used the landscape/seascape approach (because geophysical and oceanographic information was readily available) with the exceptions of Germany and California. Alternatively, one participant suggested that national consistency could be achieved by setting goals to maximize conservation outcomes and guide the identification of areas suitable for inclusion in bioregional networks without identifying minimum parameters and variables for seascape characterization. This was done in Australia for the National Representative System of Marine Protected Areas (NRMSPA),
- Since there is a need to capture the full range of ecosystems in the bioregion, it was noted that the scale of subdivision could get very fine. It may be useful to provide guidance on a 'stopping rule' to limit the level of subdivision. It was noted that habitat classification at a medium scale could be used to help resolve this problem. However, there would be challenges to identifying a 'stopping rule' without considering the full network as well as integrated processes such as connectivity among areas.
- It was questioned whether an MPA could encompass only the upper portion of water or a benthic area. It was noted that this is possible. Additionally, it was noted that benthic and pelagic environments should be considered separately when classifying habitats since, for the majority of cases, pelagic seascapes are defined at a coarser scale than benthic seascapes. Furthermore, it was suggested that coastal or territorial sea be separated from offshore areas (i.e., delineate the coastal zone) in each bioregion, and that classification proceed at these two different scales.
- There also was a question to clarify what is meant by coastal / territorial sea (although this is defined in the *Oceans Act)*. It was noted that there is no national consistency and guidance is needed on how to make these distinctions.

ACHIEVING REPRESENTATION AT DIFFERENT SCALES AND DATA AVAILABILITIES USING ECOLOGICAL CLASSIFICATIONS

Presenter – M. Greenlaw

Abstract

A representative MPA network plan could have various possible configurations. The Maritimes region has had experience providing ecological classifications at different scales (Offshore, Coastal Sub-tidal and Coastline) with different levels of planning time, funding, and experience to provide advice on the factors that should be considered when selecting the appropriate scale for representative MPA network planning. At the bioregional level, a single MPA could not be considered to capture the range of species and habitats. Depending on the resolution and type of data available only certain levels of delineation of the ecosystem will be possible; these will inevitably differ between bioregions (e.g., Arctic vs. Maritimes) and even within sections of a bioregion (pelagic vs. benthic, coastal vs. offshore). It is suggested that scales be chosen separately for each bioregion and according to each representative area classification scheme used, based on data availability and experience of those creating the classifications. Another important consideration that must be balanced with the choice of scale is the accuracy of the classification. The choice of ecological classification method (using only physical factors, or both physical and biological factors) will highly influence the accuracy of the classification, along with

the resolution of the data available. It is suggested that each region start with the most accurate method possible, or compare methods. In the Maritimes Region, past classifications have all used physical-only approaches; however a method using both biological and physical variables has been discussed for future planning in the offshore (i.e., Gradient Forest). Gradient Forest is a method that is currently in use to update Australia's representative planning. It is suggested that biological data be used, if possible, although it might be best to compare methods with and without biological data, given that the data will be biased towards large visible components of the ecosystem, and commercially important species. From applying Gradient Forest in the Gulf of Maine, the Maritimes Region has learned that the physical factors that control diversity and distribution of species differ from what was expected. This knowledge is applicable for planning regionally and nationally. It is suggested that planners should start with regional experience for which factors are important for controlling species diversity and distribution, then incorporate national and then international experience.

Discussion

- There were questions concerning the data demands for the different approaches and the length of time to do the analysis. It was recognized that Gradient Forest is time/labour intensive, requires extensive GIS and statistical expertise, and requires biological data that are well distributed across the bioregion.
- There was a discussion about the availability of biological data to apply the approach. Although historical benthic grab datasets had been used, there were problems with the accuracy of the data. It was also noted that the method can use different types of data where necessary, as survey data might be limited in extent and data must be evenly distributed across the entire range. Another suggestion was to use fish diet data.
- The scale of observation was noted to be very important. Another consideration is whether the data were collected during the same place/time or at different places/times.
- It was commented that a comparison of results from separate geophysical, biological, and Delphi models would be useful to determine if there is convergence, as opposed to mixed models.

GENERAL DISCUSSION

- There are 12 marine bioregions (and one in the Great Lakes) so the question is how these could be subdivided to encompass ecological functions. It was agreed that ecological functions indicated in the Terms of Reference's objective 1 are addressed in the first paper presented. For objective 2, appropriate factors for determining scale (i.e., level of subdivision) are going to vary depending on bioregion, the ecological processes identified for protection, and data availability.
- National guidance is needed so that a nationally consistent process is in place to ensure networks are meeting national priorities and capturing the key requirements. However, these guidelines need to be general rather than specific because of the variability among bioregions.
- Available data in most bioregions pertains to patterns rather than ecological processes, thus inferring ecological processes from pattern data is required.
- There was a discussion about scale; participants were reminded to consider what size is necessary for the ecological processes to be represented.
- There was some discussion as to whether connectivity among representative areas is required. It was suggested that human activities do not create barriers to passage between spatially separated MPAs in the ocean and coastal areas the way human activities create barriers between terrestrial protected areas (those barriers being farms, highways, urban

areas, etc). In all but very rare situations (e.g., the Canso Causeway), passage from one area of the sea to another nearby area is assured. MPAs still need to be logically placed and spatially configured, but "connectivity", as it is used in the MPA literature, is an MPA network design feature for enhancing the synergistic contribution of all MPAs in the network and not necessarily a feature essential to achieving protection of an individual MPA. When considering the conservation value of an individual MPA and the interactions among MPAs in a network, how management is conducted outside the MPAs is an essential component of conservation success.

- Biological information or analysis is required to have confidence that an MPA network has met the representativity property. A network should be representative of all ecological functions, and these functions will determine the subdivision required.

DRAFTING OF SCIENCE ADVICE

- It was agreed that bioregional ecological functions include: primary production, grazing, benthic community processes, benthic-pelagic coupling, and piscivorous predation.
- It was agreed that well designed pelagic MPAs can deliver good benthic outcomes whereas the reverse is not necessarily true, due to the scale at which processes occur.
- To satisfy the ecological functions, MPA networks need to be on the scale of 100s to 1000s of square km.
- It was noted that the statement that exploitation should be 1/3 or less of natural mortality is too prescriptive and there was a request to remove this statement from the advice as it is not supported by data. It was agreed that the statement would not be reflected in the advice stemming from the meeting.

REFERENCES CITED

DFO. 2004. Identification of Ecologically and Biologically Significant Areas. DFO. Can. Sci. Advis. Sec. Ecosystem Status Rep. 2004/006.

DFO. 2009. Development of a Framework and Principles for the Biogeographic Classification of Canadian Marine Areas. DFO. Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/056.

DFO. 2010. Science Guidance on the Development of Networks of Marine Protected Areas (MPAs). DFO. Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/061.

DFO. 2011. Ecologically and Biologically Significant Areas – Lessons Learned. DFO. Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/049.

Rice, J. and K. Houston. 2011. Representativity and networks of Marine Protected Areas. Aquatic Conserv: Mar. Freshw. Ecosyst. 21: 649–657

UNEP. 2008. Decision Adopted by the Conference of the Parties to the Convention on Biological Diversity at its Ninth Meeting (UNEP/CBD/COP/DEC/IX/20), Decision IX/20 Annex II: Scientific Guidance for Selecting Areas to Establish a Representative Network of Marine Protected Areas, Including in Open-Ocean Waters and Deep-Sea Habitats (CBD, 2008).

APPENDIX 1. TERMS OF REFERENCE

Guidance on "Representative" Marine Protected Areas for Network Planning

National Peer Review, National Capital Region

October 2, 2012
Montreal, Quebec

Chairperson: Eddy Kennedy

Context

Canada has both domestic and international commitments to establish a national network of Marine Protected Areas (MPAs). Towards this goal, Fisheries and Oceans Canada (DFO) is working with federal, provincial and territorial partners to design and establish the Canadian network of MPAs in accordance to Decision IX/20 of the Convention on Biological Diversity (UNEP 2008). The required network properties and components identified in Annex II of the CBD Decision, amongst others, include Ecologically and Biologically Significant Areas (EBSAs) and "representativity".

In 2004, Science provided advice on the identification of EBSAs (DFO 2004). This advice was reviewed and updated in 2011 (DFO 2011). Further to this advice, Science hosted two advisory processes in 2009 that laid much of the foundation for how Canada can proceed to establish its representative network of MPAs. The first advisory process addressed the identification of Canada's marine biogeographic units and guidance on factors to consider in the next level(s) of subdivision (DFO 2009). The second advisory process provided general guidance on the necessary properties of networks of marine protected areas, including representative areas (DFO 2010).

However, the science advice from the 2009 meetings (DFO 2009 and 2010) did not provide a framework that could be followed to ensure consistency in the selection of the scale (level of subdivisions) at which "representativity" must be achieved within the network, nor regarding how an area would be considered to be representative or what ecological functions are to be served by representative areas. Thus, there is a need to develop a nationally consistent interpretation of "representativity" and to provide guidance for MPA network practitioners on the identification of "representative" areas within a biogeographic unit (bioregion).

Objectives

The objectives of this peer review process are to develop a nationally consistent interpretation of "representativity" in the context of Canada's network of marine protected areas, and to provide specific guidance on:

- The ecological functions that are to be served by "representative" areas within an MPA network, as well as the required properties to ensure those functions are sustained;
- The appropriate factors to consider in selecting the scale (level of subdivision) to produce units that need to be represented in the network.

The following working papers will provide the basis for discussion and advice:

Objective 1: Rice, J., Houston, K. 2011. Representativity and networks of Marine Protected Areas. Aquatic Conserv: Mar. Freshw. Ecosyst. 21: 649-657.

Objective 2: Two working papers will be presented, the first will present a review of international approaches to scale selection for representativity, and the second one will present a coastal classification system used in the DFO Maritimes Region.

Expected publications

- Proceedings
- Science Advisory Report
- Research Documents

Participation

- DFO Ecosystems and Oceans Science
- DFO Program Policy
- DFO Regions - Oceans
- Parks Canada
- Environment Canada
- Provincial/Territorial experts
- Academia

References Cited

DFO. 2004. Identification of Ecologically and Biologically Significant Areas. DFO. Can. Sci. Advis. Sec. Ecosystem Status Rep. 2004/006.

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APPENDIX 2. LIST OF PARTICIPANTS

Participant	Region
Eddy Kennedy	Maritimes
Jake Rice	NHQ
Cecilia Lougheed	NHQ
Sherry Walker	NHQ
Mary Rothfels	NHQ
Victoria Sheppard	NHQ
Jessica Mitchel	NHQ
Jim Boutillier	Pacific
Miriam O	Pacific
Joclyn Paulic	C&A
Atef Mansour	NL
Corey Morris	NL
Nadine Templeman	NL
Michelle Greenlaw	Maritimes
Nancy Shackell	Maritimes
Alida Bundy	Maritimes
Karen Leslie	Pacific
Leah Brown	C&A
Guy Cantin	Quebec
Laura Park	NL
Christine Ferron	Gulf
Marty King	Maritimes
Maxine Westhead	Maritimes
Francine Mercier	OGD
Suzan Dionne	OGD
Karel Allard	OGD
Doug Biffard	F/P/T
David MacKinnon	F/P/T
John Roff	Academia
Isabelle Cote	Academia
Glen Jamieson	Consultant

APPENDIX 3. M. GREENLAW'S EXPERT REVIEW OF INTERNATIONAL APPROACHES TO CHARACTERIZING MARINE SEASCAPES TO ACHIEVE REPRESENTATIVITY IN MPA NETWORK DESIGN

- The document does a good job at summarizing the main examples of international approaches to representative planning, for MPA planning purposes.
- It is obvious that many countries have taken an approach very similar to the early work of Roff and Taylor (2000) who mapped marine landscapes/seascapes. This original work justified using physical oceanographic information in lieu of biological information, as they have very strong ecological relationships that are well documented, and biological information is often missing
- There were countries that went about planning with different approaches, such as using a method based on the classification derived by the European Union, EUNIS.
- There were only a couple countries that used more progressive approaches, or used biological data at all.
- Australia had the most progressive approach, and explicit MPA Network planning goals for oceanographic and biological factors.
- The document does a great job at summarizing international examples However, it does not summarize the breadth of knowledge about representative planning methods.
- Knowledge of how to best complete representative planning has become more sophisticated since Roff and Taylor's original application, and international work often reflects methods that are simplistic. Often, at a National extent, these are the only methods that are possible to use, given data limitations, but more sophisticated methods should be discussed, as some have even been applied in parts of Canada already. These are being used to update at least one of these international examples with a more sophisticated approach.
- With respect to current planning in Australia, there is work in progress to update planning with layers that are created using a suite of biological data and a very intensive method.
- There is also, from a specific selection of publications in journal articles, much more knowledge of the best physical factors to use even when using a physical-only approach.